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2,924,911

BLAST FINISHING MACHINE

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14 Claims. (Cl. 51-9)

This invention relates to blasting processes, such as are used for abrading, peening, polishing, cleaning, surface hardening, and the like. More particularly the invention relates to improved means for sealing the work piece passages or other openings into the chambers or enclosures within which such blasting operations are performed.

Air and airless abrasive blasting techniques which are in widespread use for example in descaling, deburring, deflashing, and in the cleaning and polishing of weldments, and castings of metal and plastics and other materials, as well as for shot-peening and similar operations, require the use of effectively sealed cabinets or enclosures surrounding the blasting operations to protect attendant personnel and to insure recovery and efficient use of the shot or other abrasive media. Escape of the blast media renders such operations extremely hazardous to attendant personnel, and such loss of the media involves undesirable expense.

The sealing of necessary openings in such enclosures has long been a problem in the art; and previously developed sealing means such as gaskets of rubber or other materials, labyrinth baffles, and so forth, all have serious shortcomings. The problem is especially difficult when using relatively high specific gravity ferrous particle blasting media of minute size. Seals of the prior art have been defective in that they do not, even when newly installed, provide practicable sealing effects, and tend to deteriorate in use under the impact and abrasion effects of the blasting particles.

Accordingly, one object of the present invention is to provide improved means for sealing enclosures for blast abrading operations which will prevent escape of the blasting media from the enclosures.

Another object of the invention is to provide an improved sealing means as aforesaid which embodies a sealing curtain of such character as to be free from wear or other deterioration, and which will thus require no curtain maintenance or repair.

Yet another object of the invention is to provide a sealing means as aforesaid which is not deleteriously affected by either extremely high or low temperatures such as are sometimes encountered in blasting operations in the various industries.

Still another object of the invention is to provide an improved sealing means as aforesaid which facilitates insertion and withdrawal therethrough of workpieces of various dimensions and shapes without affecting the integrity of the seal.

A number of other objects and advantages of the invention will appear from the detailed description hereinafter and the accompanying drawings wherein:

Fig. 1 is a vertical sectional view of a shot blasting device utilizing one form of the sealing means of the invention;

Fig. 2 is a fragmentary sectional view showing another form of the sealing means of the invention;

Fig. 3 is a sectional view taken along line III—III of Fig. 2;

Fig. 4 is a sectional view taken on line IV—IV of Fig. 2;

Figs. 5, 6, 7, are views of still other examples of use of sealing means of the invention;

Fig. 8 is a fragmentary side elevational view, partly in section, of still another form of blasting machine embodying sealing means of the invention;

Fig. 9 is a fragmentary sectional view, on enlarged scale, taken along line IX—IX of Fig. 8; and

Fig. 10 is a fragmentary sectional view on enlarged scale, taken along line X—X of Fig. 8.

It has been discovered that where a ferrous or other magnetizable particle media is being used in a blasting operation, an improved sealing arrangement may be provided by using the media itself as the sealant. Thus, the present invention generally contemplates an arrangement whereby the magnetizable quality of the abrasive media is utilized by subjecting it to effects of a series of magnets arranged adjacent the opening to be sealed, so as to set up a magnetic field across the opening to cause some of the media particles to accrete into the form of a wall closing the opening. This wall is impenetrable to passage of flying media, but is readily penetrable by the infedding or discharging workpieces.

More specifically, Fig. 1 illustrates an example of an abrading apparatus using a sealing means of the invention, wherein a housing 10 is provided with a centrifugal throwing wheel 12 mounted in its upper wall. The wheel 12 is fed abrasive material from a hopper 14 through a chute 16 and through 18. The lower side walls of the enclosure preferably taper inwardly to terminate in a trough-like bottom portion 19 of the enclosure. Spent abrading or polishing media will of course fall to the bottom 19 of the enclosure and will be returned to the feed hopper 14 by means of a screw conveyor as indicated at 20, and a bucket conveyor as indicated at 22.

As shown, housing 10 of Fig. 1 is provided with an opening at each end thereof so that workpieces may be continuously fed therethrough, and so that the lengths of the workpieces to be treated are not limited by the size of the enclosure. Effective sealing means for these openings must closely surround incoming and outgoing workpieces, and in order that the seals not be limited to use with any one size or sectional shape of workpiece, they must be capable of adapting to fit variously shaped and dimensioned workpieces while still providing optimum sealing.

In accordance with the present invention, magnetic fields are established across the openings by positioning horseshoe-shaped permanent magnets 24 above and below each of said openings. The magnetic field thus established therebetween attracts and tends to accrete across each opening a wall composed of the ferrous abrading media, thereby forming closely packed curtains of the media across the openings. The housings 26, 26 for the magnets may be formed of wood, metal or other material. If the housings are fabricated of steel as shown, linings 28 of non-magnetic material, such as rubber, are preferably provided to encase the magnets except for their opposed faces, so as to magnetically isolate them from the steel cabinet 10.

I have found that such curtains of abrading media form very effective seals for the blast material being thrown into and rebounding within the enclosure at high velocity nevertheless, workpieces may be readily pushed through the curtains displacing the magnetized particles they encounter in directions transversely of the magnetic field, while the particles surrounding the sides of the workpieces maintain close, firm seals therearound. Thus effective seals which automatically shape themselves to

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objects being thrust therethrough are established by an arrangement of utmost simplicity.

When a blasting operation is to be initiated, the sealing curtain may be established by hand-feeding some of the abrasive media to the magnetic field. Then, as explained hereinabove, as workpieces are fed through the curtain the material forming the seal at the intake end of the enclosure directly ahead of the workpiece will be displaced inwardly by the traveling workpiece while the adjacent material clings to the sides of the workpiece. In order to assure maintenance of the seal, a seal feeding hopper 30, is provided at the upper edge of the workpiece intake opening, adjacent the outer face of the seal. Media from the hopper 30 is arranged to trickle across the outer face of the seal and, due to the action of the magnetic field, will maintain the curtain at full thickness and density. As shown, the seal feeding hopper 30 may be fed from the main hopper 14 by means of an auxiliary feed conduit 32, or the like. To prevent the loss of media due to any possible over-supply from the hopper 30, a catch trough 34 may be provided below the opening to catch surplus media and return it to the enclosure through chute 35.

At the workpiece discharge opening, curtain material displaced outwardly by the travel of the workpiece will automatically be replaced from material flying around inside the enclosure. A second catch trough 36 is preferably arranged outside the discharge opening to catch and return to the enclosure the abrasive media which may be displaced outwardly from the curtain seal by the workpiece.

While Fig. 1 shows the use of horseshoe-shaped magnets, it will be appreciated that any other suitable means for establishing a magnetic field may be utilized. Electromagnets and permanent magnets of bar, circular, or any other desired form may be used; alone, or in any desired combination or arrangement. For instance, one preferred form of magnet arrangement is shown in Figs. 2-4.

In this case the end wall at the discharge end of a blasting enclosure is indicated at 40 and has the magnet assembly 42 mounted thereon as by means of bolts 44. The magnet assembly is carried by a steel frame comprising an end wall 46 and top, bottom and side walls 48. Groups of permanent ceramic bar magnets 50 are supported above and below the workpiece opening through the magnet assembly and are mounted in place by a mild steel shell 52 carried by the frame walls 48. To minimize distortion of the magnetic field established by the magnets 50, the magnets are insulated by slabs of rubber 54 at each end of the magnet assembly, and by sheets of rubber 56 placed between the magnets and the mild steel along the side wall portions of the assembly. The lower face of the upper group of magnets and the upper face of the lower group of magnets are lined with aluminum as indicated at 58.

It may be desirable to provide an internal flange portion at the outer edge of one or both of the aluminum liners 58 as indicated at 59. This will reduce somewhat the amount of entrained media which is displaced outwardly incidental to the travel of a workpiece. It should be noted that, inasmuch as differently sized openings and different magnet assemblies may be desired for various types and sizes of workpieces to be treated in the blasting enclosure, the opening 41 provided in the enclosure end wall 40 may be made of the maximum size required in any case, while the opening 47 in the end wall 46 of the magnet assembly will be sized and shaped generally compatibly with the shape and sectional dimensions of the type workpiece for which the particular magnet assembly is designed. Thus a variety of magnet assemblies of specialized nature may be used on the same enclosure to suit different workpiece runs.

As shown in Figs. 2, 3, provision is preferably included to recover blasting media from the workpieces such as may become magnetized incidental to their passage through the enclosure, whereby the blasting particles from

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the curtain at the outlet end of the enclosure tend to cling to the workpieces after they emerge from the curtain. As shown, a demagnetizing arrangement as indicated generally at 60 may be provided in the form of an electromagnet 62 having a central opening as indicated at 64 through which the workpieces may pass. Thus the demagnetized unit 60 may be readily mounted adjacent the machine as by means of brackets 66, 67. The demagnetizing coil 62 is arranged to be energized by alternating current through conductors 68; and thus it will be understood that upon passage of the workpieces of the unit 60 the workpieces will be demagnetized and the clinging media will fall therefrom as to a collection hopper as indicated at 70 for subsequent recovery and reuse.

Fig. 5 illustrates application of the invention to other type openings in the blasting process enclosure, such as a hatch way provided in a wall portion 72 of the enclosure. A door 74 for the opening, hingedly or otherwise mounted as may be preferred upon the wall 72, is arranged to cover the access opening, but to effectively seal the juncture between the door 74 and the marginal portions of the wall 72, a sealing curtain arrangement of the invention is provided interiorly of the device. Thus as shown in Fig. 5, a permanent magnet such as indicated at 75 is arranged to ring the access opening, and is conveniently mounted thereon by embedding it in a non-magnetic mounting frame 76 which is in turn fastened by any suitable means to the wall 72. Thus the magnetic field extending from the magnet ring 75 will in part flow into and through the closure plate 74, whereby the ferrous blasting media will tend to accumulate as indicated at 78 between the magnet and the closure plate 74, thereby setting up a sealing wall at the closure juncture preventing loss therethrough of any blasting media.

Fig. 6 illustrates application of the invention to a traveling blasting machine which is designated generally at 80 and is illustrated as operating upon a work piece 82. Thus the work piece may comprise any relatively large surface from which it is required to remove surface scale or the like as indicated at 84. As shown in the drawing, the machine may comprise a housing 85 mounting a media throwing wheel 86 driven by suitable drive means such as motor and belt drive units 87-88. The wheel 86 is arranged to be fed blasting media from a hopper 89; the same to be in turn supplied with fresh and spent media collected at the bottom of the housing 85 and conveyed to the hopper by any suitable means (not shown). Thus, the media is projected from the wheel as indicated at 90 against the work piece to provide the desired surface treatment, as explained hereinafter.

To seal the juncture between the machine and the work piece an arrangement of the invention is provided to include magnet means at the sides of the housing at their work piece contacting edges. In Fig. 6 the magnet means comprise magnetic pulleys 92-92 which establish magnetic fields operable to trap flying media and to cause it to accrete into the form of solid walls of magnetically bound media as illustrated at 94. These walls effectively curtain off the operation against escape of flying media without interfering with movement of the machine relative to the work piece incidental to progress of the cleaning operation across the work piece. Also, provision may be included to prevent loss of sealing media due to movement of the machine relative to the work piece. For example, as shown in Fig. 6, endless belts 96-96 of non-magnetic material may be trained around the pulleys 92-92 and around non-magnetic companion pulleys 98-98 disposed interiorly of the machine; the pulleys being driven by any suitable means to tend to drag the sealing media into the housing. Thus, tendency of the media to remain behind on the workpiece as the machine moves ahead will be counteracted by the tendency of the belts to pull the media into the housing.

Fig. 7 illustrates another arrangement of the invention for sealing a moving blasting machine relative to a work-

piece. Furthermore, Fig. 7 illustrates how the seal of the invention is equally applicable to non-planar surfaces, such as a ship hull in dry dock, or the like. In this case the housing 85 is fitted with permanent magnets 100 encircling its workpiece facing edge, whereby the magnets 100 set up magnetic fields causing the media to accrete as indicated at 102 in the form of walls curtaining the juncture between the machine and the workpiece against escape of flying media from interiorly of the machine.

Figs. 8, 9, 10, illustrate the application of a sealing device of the invention to a blasting machine installation of the type comprising a relatively large chamber having wall portions designated 110, 112 for accommodation therein of relatively large size workpieces to be cleaned or otherwise abrasion surfaced-treated as explained hereinabove. In this case the blast media projecting machine as designated generally at 115 is mounted upon a base 116 which also carries the machine driving mechanism 118. The base plate 116 is slidably mounted upon a trackway 120, whereby the blasting machine may be moved at will to project different distances into the workpiece chamber, to suit different operating conditions. The machine 115 is housed within an abrasion resistant housing designated 122 which is arranged to telescopically fit within a complementary shaped opening in the wall 110 of the work piece chamber.

To seal the opening between the housing 122 and the wall 110, a sealing device of the invention is provided to include a series of permanent magnets designated 125 disposed perimetricaly of the opening to be sealed. Thus for example the magnet system may comprise paired magnets 126, 127 carried in channel members 128 which are supported on insulation pads 129 and mounted in housing channels 130, as by means of pins 131. Insulation plates 132 are disposed at opposite sides of the magnets to hold them in position in the channels 128; the channels 128, 130 being of conductive material whereby magnetic flux patterns as indicated at 135 (Fig. 9) are set up to span the space between the magnet system 125 and the adjacent housing structure 122. The magnet supporting channels 130 are conveniently mounted upon the casing chamber wall 110 by means of brackets 138.

Thus, it will be appreciated that the opening between the housing 122 and the chamber wall 110 will be spanned by magnetic flux fields which will attract and hold sealing curtains of the blasting media particles as explained hereinabove; while at times permitting telescopic movements of the housing 122 relative to the chamber wall 110.

It is to be understood that whereas only a few forms of the invention have been shown and described herein, it will be understood that various changes may be made therein without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A blast finishing machine comprising, a casing having a workpiece reception opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, and magnet means disposed to embrace said opening and operable to project a magnetic field extending from the marginal edge of said opening to span the opening, whereby media will become entrained by said magnetic field and agglomerate to form a wall of media particles clinging together in such manner as to close said opening against passage therethrough of other projectile media particles while permitting penetration and/or withdrawal therethrough of workpieces.

2. A blast finishing machine comprising, a casing having reception openings at opposite sides thereof for a workpiece of a length dimension greater than the width of said machine casing, a blasting media projecting machine discharging magnetizable media into the interior of said casing, and magnet means disposed adjacent said openings and operable to project magnetic fields spanning said openings, whereby magnetizable media will become en-

trained by said magnetic fields and cling together to form walls of media particles permitting penetration and/or withdrawal therethrough of workpieces while hugging the workpieces to block passage of other projectile media particles.

3. A blast finishing machine comprising, a casing having a workpiece accommodating opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, magnet means disposed to bracket said opening and operable to project a magnetic field, whereby media from within said casing will become entrained by said magnetic field and agglomerate to form a wall of clinging media particles operable to block passage therethrough of other projectile media particles while permitting penetration and/or withdrawal therethrough of workpieces, the openings through said wall made by passage of workpieces being automatically self-healing.

4. A blast finishing machine comprising, a casing having a workpiece accommodating opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, magnet means disposed to bracket said opening and operable to project a magnetic field, whereby media from within said casing will become entrained by said magnetic field and agglomerate to form a wall of clinging media particles operable to block passage therethrough of other projectile media particles while permitting penetration and/or withdrawal therethrough of workpieces, the openings through said wall made by passage of workpieces being automatically self-healing, and a demagnetizing device disposed externally of said casing and operable incidental to discharge of workpieces therefrom to shuck clinging media from said workpieces.

5. A machine comprising a casing enclosing projectile magnetizable particles and having a workpiece reception opening, and magnet means disposed adjacent said opening and operable to project a magnetic field across said opening, whereby projectile media moving into the range of said magnetic field will become arrested thereby and agglomerate to form a wall of media particles clinging together in such manner as to block passage therethrough of other projectile media particles while permitting penetration and withdrawal therethrough of workpieces.

6. A blast finishing machine comprising, a casing having a workpiece reception opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, magnet means disposed adjacent said opening and operable to project a magnetic field extending from the marginal edge of said opening to the workpiece disposed therein, whereby media moving into the range of said magnetic field will become arrested thereby and agglomerate to form a seal of media particles clinging together in such manner as to block passage therethrough of other projectile media particles while permitting relative movement between said machine and said workpiece.

7. A blasting finishing machine comprising, a casing having a workpiece reception opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, and magnet means disposed adjacent said opening and operable to project a magnetic field extending from the marginal edge of said opening, whereby media will be caught and held by said magnetic field thereby forming an agglomerate wall of media particles clinging together in such manner as to close said opening against passage therethrough of other media particles while permitting penetration and/or withdrawal therethrough of workpieces.

8. A blast finishing machine comprising, a casing having a workpiece reception opening against which a closing device may be applied, a blasting media projecting machine discharging magnetizable media into the interior of said casing, and magnet means disposed to embrace said opening and operable to establish a magnetic

field extending from the marginal edge of said opening into reach of said closing device, whereby media will become entrained by said magnetic field and agglomerate to form a wall of media particles clinging together in such manner as to seal the juncture of said casing and closing device, against passage therethrough of other projectile media particles.

9. A blast finishing machine comprising, a casing having reception openings at opposite sides thereof for workpieces of length dimensions greater than the width of said machine casing, a blasting media projecting machine discharging magnetizable media into the interior of said casing, magnet means disposed adjacent the workpiece inlet opening and operable to establish a magnetic field across said opening, whereby magnetizable media will be caught and held by said magnetic field and agglomerate to form a wall of media particles clinging together in such manner as to permit penetration therethrough of workpieces while clinging thereto to block passage of other projectile media particles, and auxiliary media supply means externally of said wall operable to replace media which may be displaced from said agglomerate wall by movement of workpieces.

10. A blast finishing machine adapted for relative movement operation upon a large workpiece surface, said machine comprising, a casing having a workpiece reception opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, magnet means disposed adjacent said opening and operable to project a magnetic field extending from the marginal edge of said opening towards the workpiece when disposed in operative position, whereby media moving into the range of said magnetic field will agglomerate to form a seal of media particles clinging together in such manner as to block passage therethrough of other projectile media particles while permitting relative movement between said machine and said workpiece.

11. A machine as set forth in claim 10 wherein the magnet means comprises a magnetic pulley having a media conveying belt training therearound to impel loose media to move into the interior of said casing.

12. A blast finishing machine comprising, a casing having a workpiece reception opening, a blasting media projecting machine discharging magnetizable media into the interior of said casing, magnet means disposed adja-

cent said opening and operable to establish a magnetic field extending from the marginal edge of said opening towards the workpiece disposed therein and means delivering media into the range of said magnetic field to form a sealing curtain of media particles blocking passage therethrough of other projectile media particles while permitting movements of workpieces relative to said opening.

13. A blast finishing machine comprising, a chamber for accommodating a workpiece to be processed, said chamber having a wall portion thereof formed with an opening, a housing sectionally shaped to substantially complement the shape of said opening and to telescopically fit therein, a blasting media projecting machine mounted within said housing for discharging magnetizable media into the interior of said chamber, and magnet means disposed to embrace said opening and operable to establish a magnetic field extending from the marginal edge of said opening into reach of said housing whereby media inside said chamber will become entrained by said magnetic field and agglomerate to form a wall of media particles clinging together in such manner as to seal the juncture of said chamber and said housing against passage therethrough of other projectile media particles.

14. A blast processing machine comprising, a chamber for accommodating a workpiece to be processed, said chamber having a wall portion thereof formed with an opening, a housing sectionally shaped to telescopically fit into said opening, a blasting machine mounted within said housing for discharging magnetizable blasting media into the interior of said chamber, and magnet means adjacent said opening and operable to establish a magnetic field extending between the marginal edge of said opening and said housing, whereby blasting media will be trapped by said magnetic field to form a wall of media particles clinging magnetically together in such manner as to seal the opening between said chamber and said housing against passage therethrough of other projectile media particles.

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R. M. LELIAERT
BLAST FINISHING MACHINE

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FIG. 1

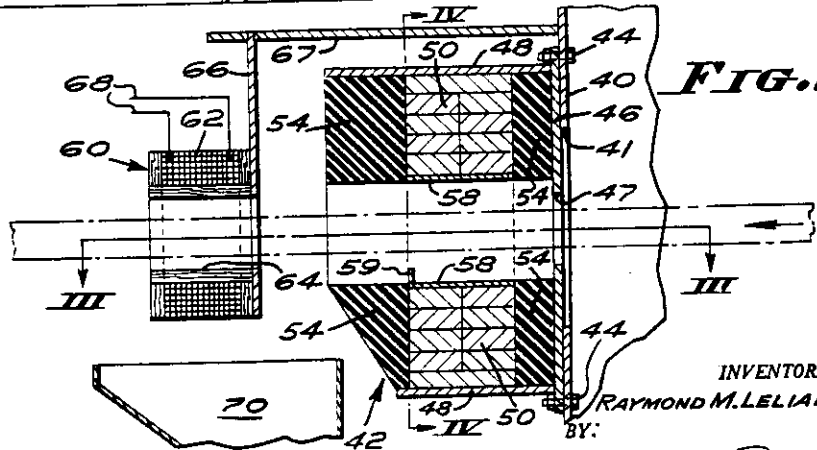
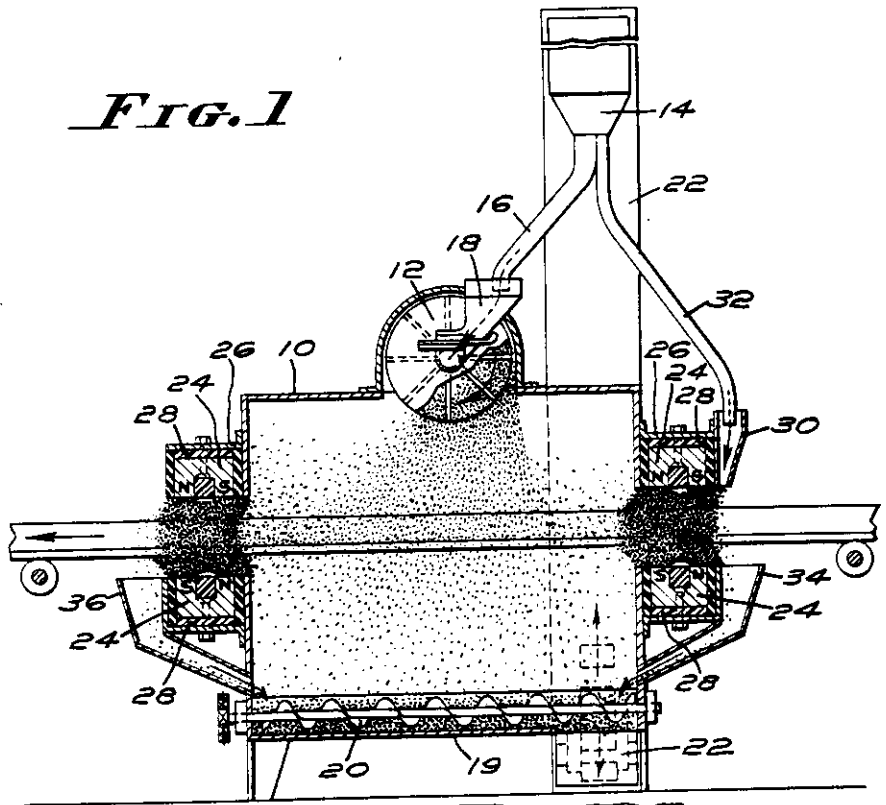


FIG. 2

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FIG. 3

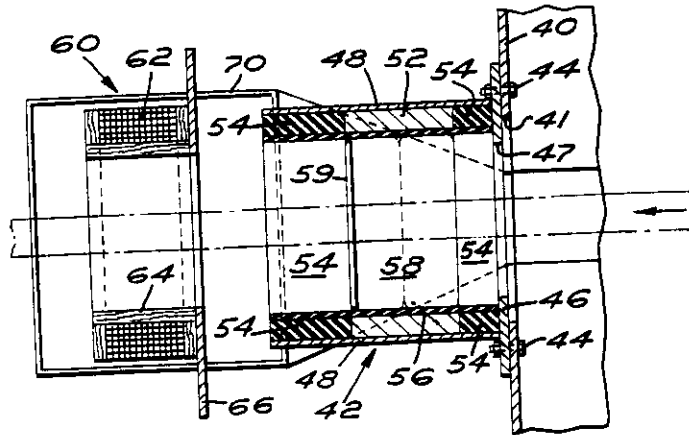


FIG. 4

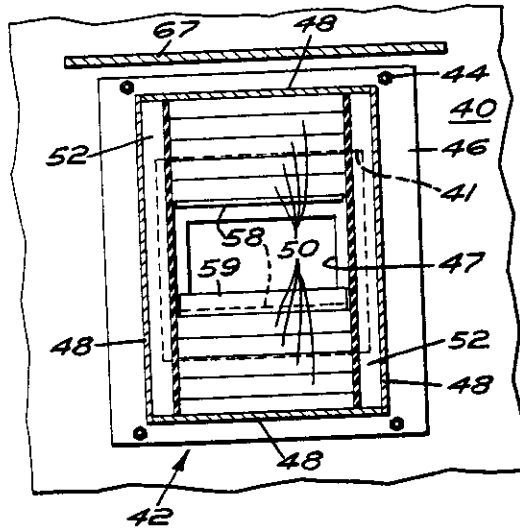
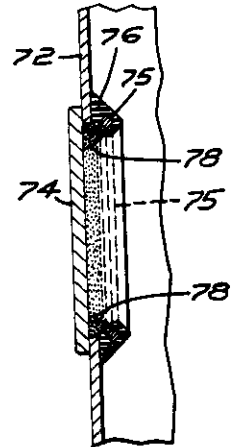


FIG. 5



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FIG. 6

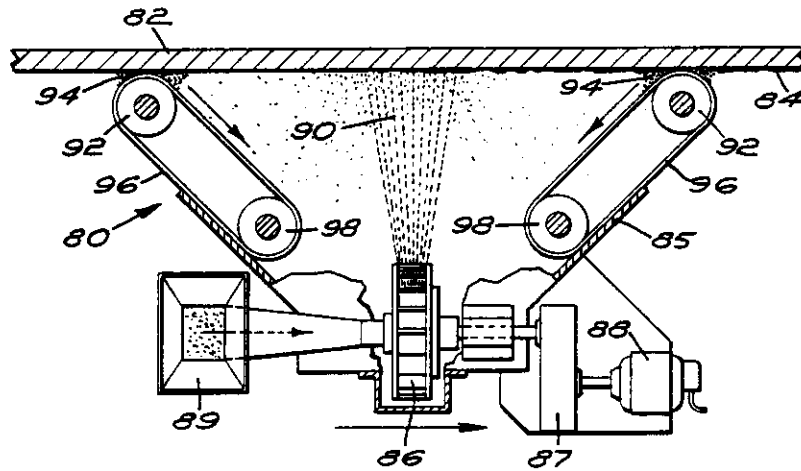
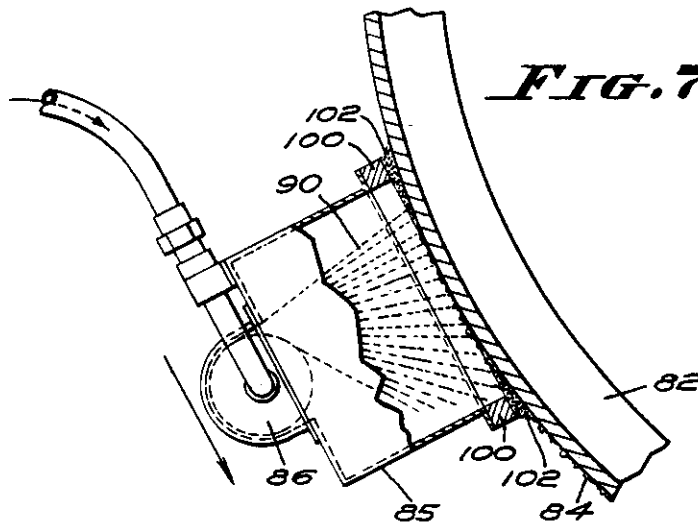


FIG. 7



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